

An Essay
on
The Eye

Respectfully submitted.
To the Faculty of the
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baffled in their attempts to apply them practically. But, happily for the success of the experiment, the mechanics of the Power that planned and completed the machine than was subject to no such imperfections as those which impede the adaptation of theory to practice, in the efforts of beings lower in the scale.

It was once stated as the unsatisfactory result of his labours by one who had made Mechanics the subject of much study that, "there is no law in the Science so true as that the actual and theoretical powers of a machine never coincide". The point of this assertion so far as it concerns the contrivances of human ingenuity is sufficiently evident to those who after having attentively studied the laws of the science find themselves

baffled in their attempts to apply them practically. But, happily for the success of the experiment, the mechanics of the Power, that planned and completed the machine Man was subject to no such imperfections as those which impede the adaptation of theory to practice, in the efforts of beings lower in the scale of intelligence. So far from true is the statement of the Sage mathematician, above quoted, as regards the construction of man, that the mind of the student can but be filled with admiration as he acquaints himself successively ^{with} the organs and functions of his system and observes how perfectly the former are adapted to the performance of the latter.

Amidst the vast number of attrac-

tive subjects which a glance at ourselves supplies, the difficulty in selecting one for particular study does not consist in finding one of sufficient interest but in choosing one to which we can justly yield a preference. Perhaps however, there is no one of them all possessed of more interest to us, both for the beauty of the organ involved and for the utility and pleasure afforded by its use than the eye.

To introduce our subject properly it will be in order first to give a description of the anatomy of the eye and its appendages.

The eye is a perfect optical instrument of a spherical form, imbedded in a cellular membrane containing adipose matter for the convenience of its motions.

Attached to the eye proper are several auxiliary parts which afford it motion and protection. It is by some considered a

The eye proper consists
1st. - of the Sclerotic, Choroid and Retina - coats

2nd. - of the Aqueous and Vitreous humours and Crystalline lens

3rd. - of the Iris and Pupil - the Ciliary ligament, bodies and processes -

The appendages consist

1st. - of the apparatus of motion

2nd. - Conjunctiva

3rd. Lacrymal apparatus, and

4th. Eye-brows - lids and lashes

The Sclerotic or outer coat of the eye takes its name from the Greek, scleros, hard. It is composed of dense, opaque, white

fibres of great firmness which form a strong membrane that gives to the eye its spherical form. It is by some considered a prolongation of the dura mater accompanying the optic nerve which in the orbit separates into two layers the one adhering to the globe of the eye, the other spreading over the periosteum of the orbit and losing itself thereupon. Posteriorly the sclerotic is penetrated by the optic nerve, which does not enter it directly in the centre of the axis of the Cornea and pupil but a little to the inner side of this point. Here the tissue is thin, and instead of entering through a single foramen the optic nerve divides into small filaments and passes through a number of small openings called

lamina cribrosa). Immediately around the optic nerve it is perforated by a great number of oblique foramina through which the ciliary arteries and nerves enter. In front of these are other small openings, through which the veins emerge from the interior and near its anterior border where it joins the cornea are a few openings which give entry and exit to the vessels of the iris. The sclerotic is the place of insertion for the muscles which move the eyeball and is intended as a protection for the delicate organ which it invests. This coat forms about five sixths of the first outer coat of the ball; the remaining sixth is formed by the Cornea to which it is firmly attached.

The cornea, so called from its resemblance to horn is a transparent membrane forming the anterior sixth of the outer coat of the ball. It is said to be superior in strength to the sclerotic into the anterior border of which it is dovetailed by bevelled edges. It is also a segment of a smaller circle from whence the anterior portion of the ball derives its greater prominence. Once it was considered a prolongation of the sclerotic but that they are distinct may be proved by maceration. It is composed of five laminae and like the corneous tissues in general possesses neither bloodvessels nor nerves. It is covered in front by a delicate epithelium derived from the conjunctiva which is

reflected over it from the cartilages of the eyelids and from which it can also be separated by maceration. Its shape is not perfectly circular but rather oval its long diameter being transverse.

The second coat of the eye is the Choroid which is in contact with and lines the Sclerotic nearly throughout its entire extent. The general connection between them is slight, consisting of a fine cellular substance, the membrana fusca and small blood vessels and nerves. Immediately around the margin of the cornea however the attachment is made much firmer by the intervention of a cellular substance, which though soft, is dense, compact and thick. This substance extends

around the circumference of the cornea forming a ring which constitutes the ciliary ligament. The choroid is an exceedingly delicate membrane and has been considered by some anatomists as a texture composed entirely of bloodvessels and nerves. It has three sets of arteries which are derived from the ophthalmic branch of the internal carotid. These are 1st. the long ciliary arteries usually two in number: they penetrate the sclerotic at its posterior part. 2nd. the short ciliary arteries which are more numerous and penetrate the sclerotic near the optic nerve. 3rd. The anterior ciliary arteries which are not so numerous as the 2nd set and penetrate the

Sclerotic just posterior to the Cornea.

The first set of these are the only ones which are accompanied with veins which are the two long ciliary veins;

Beside these however there are several veins which are peculiar in their arrangement, running from the main trunk nearly in a semi circular curve nearly parallel to each other. From this arrangement they are called the Vasa Vorticosa.

The internal surface of this coat is covered with a colouring matter called Pigmentum Nigrum spread thickly over the anterior surface and diminishing in quantity posteriorly.

Thus it will be seen that the Choroid consists of three coats, viz; 1st The outer

or venous, 2nd. the middle or arterial, and 3rd. the lining membrane containing the pigmentum nigrum.

The Retina is the third coat of the eye and lines the Choroid. It is a soft, thin, pulpy, grayish membrane formed chiefly if not wholly by the final expansion of the optic nerve.

On its inner surface it is in contact with though not adherent to the membrane of the vitreous humor. Anteriorly it terminates near the anterior extremity of the choroid forming a ring from which a delicate membrane is given off which dips in between the ciliary processes.

A little outside of the optic nerve and in the exact axis of the eye is a

yellow spot about a line or a line and a half in extent denominated the limbus luteus.

These are the three envelopes of the eye ball. Together they form one cavity which is subdivided into chambers to contain the three humours of the eye.

The vitreous humour is the first of these and occupies the posterior part of the concavity of the eye. It is convex behind but concave in front to receive the crystalline lens which fits into it and forms its anterior boundary. It is invested by a delicate, thin, transparent membrane called tunica hyaloidea which furnishes prolongations internally that divide it into cells which are irregular in their shape. At the ante-

rior part, where the tunica hyaloides reaches the crystalline it is divided into two laminae one of which is reflected over the anterior the other over the posterior surface of the lens. Between these laminae and around the margin of the crystalline is the Canal of Petit

Immediately in front of the vitreous humour is the Crystalline lens, a small transparent body of crystalline appearance and lenticular shape, hence its name. It is situated between the aqueous and vitreous humours, and at about one third of the antero-posterior diameter of the organ. The crystalline is surrounded by its own proper capsule between which and the Membrana hyaloides already mentioned

as the external investment is secreted
a viscid, transparent fluid termed
liquor Morgagnii. It is more convex
behind than before and consists of
a number of concentric lamina in-
creasing in density from the circum-
ference to the centre. The sole bond
of union between these is some fibres
which detach themselves from the dif-
ferent lamina and adhere to those
immediately beneath.

The aqueous humour is the third
and occupies all the remaining space
between the posterior surface of the
cornea and the anterior surface of
the crystalline lens and is contained
in two chambers the Anterior and
Posterior, the division between which

is formed by the iris. This division however is not complete the Anterior and posterior chambers having a communication through the pupil. The posterior chamber is much smaller than the anterior.

The Iris is the flat, coloured membrane, just posterior to the circumference of the cornea which extends into the cavity of the eye forming the septum between the anterior and posterior chambers. In its centre is a small circular opening called the Pupil through which all the rays of light concerned in vision pass to be received by the Retina. The colour reflected from the anterior surface of the Iris gives the name of gray, blue,

hazel or black to the eye. The shade of the anterior surface of the membrane is however modified by a dark, brown colouring matter found upon its posterior surface called Uvea. The diameter of the pupil is subject to constant variation from dilatation and contraction which is due to a change in the iris. This action of the iris is considered by some anatomists as attributable to its muscularity and by others to the fact that the membrane is extile in its nature.

At the point of junction between the iris and choroid coat they are united to the sclerotic by a band of cellular substance called the ciliary ligament and from the

anterior margin of the Choroid, where it unites with the base of the iris, there are given off a number of appendages which appear to be prolongations of the anterior margin of the Choroid turning inwards towards the margin of the crystalline lens, and terminating abruptly without being attached to that body. These are the Ciliary processes, about sixty or eighty in number and are radiated in their arrangement. On their posterior surface they are coloured by the same kind of pigment as the Choroid and iris. There exists no settled opinion as regards both their structure and functions, having been considered by some as nervous, by others

muscular, glandular and vascular.

The appendages of the eye have already been enumerated and consist first of the Apparatus of motion

The eye has its own proper muscles capable of giving it motion in all necessary directions. They are six in number and arranged in two sets, viz; the four recti and the two oblique.

The first set consists of the superior, inferior, internal and external recti, which all arise from the base of the orbit around the optic foramen, pass forward and form all together a tendinous expansion over the sclerotic to which they are attached.

The second set consists of the superior and inferior oblique.

The superior oblique arises from the edge of the foramen opticum at the bottom of the orbit, from thence it runs forward over the ethmoid bone to the upper part of the orbit where its tendon passes through the cartilagenous pulley and runs downwards and outwards to be inserted like the recti into the tunica Sclerotica.

The inferior Oblique arises from the outer edge of the orbital process of the Superior Maxillary bone near its junction with the os unguis, runs obliquely outwards and is inserted in the space between the rectus internus and the optic nerve.

The uses of the recti muscles are to raise or to draw down the ball, to

to direct it towards the inner or outer
Canthus accordingly as indicated by their
respective names.

The use of the superior oblique is to
roll the globe of the eye and to turn
the pupil down and outwards. The
inferior oblique antagonizes the superior.

The eyelids are two in number
the superior, the larger and the in-
ferior. They are moveable fleshy cur-
tains nicely adapted to each other
at their free borders and fitting over
the anterior surface of the ball of
the eye which they exactly cover.

They are composed of the skin exter-
nally which at their free margin
is folded upon itself to line their
inner surface and here takes the

Character of mucous membrane and
constitutes the *Tunica Conjunctiva*.

Within these two folds are contained
a little cellular tissue, some fibres of
the levator palpebrae superioris muscle
of the cartilaginous plates which last
appears in the lower lid only at its free
border. These cartilages form the mar-
gin of each eyelid and are called
tarsal cartilages. The superior is
about six lines wide at its greatest ex-
pansion while the inferior is only about
two. They present on their inner sur-
face a number of grooves in which
are found the Meibomian glands.

The *tunica conjunctiva* is reflected
uninterruptedly from these cartilages
over the ball and at the cornea as -

sumes the character of a simple epidermis which is completely transparent. It contains bloodvessels which in a healthy state do not carry blood but receive it largely when they are inflamed. The eyelids at the union internally and externally form the inner and outer canthi.

The Lacrymal apparatus consists of the lacrymal gland of the canicula lacrymalis the lacrymal and nasal ducts.

The lacrymal gland consists of two lobes situated in the upper, anterior and outer part of the orbit. This gland secretes the tears which are conveyed off by means of six or seven excretory ducts which run nearly par-

allel to each other and open on the inner side of the upper lid near the outer angle and also near the tarsal cartilage. Through these the tears are spread over the conjunctiva.

The *caruncula lachrymalis* is composed of a number of small mucous follicles situated at the inner angle of the eye which secrete a thick whitish fluid which serves a similar purpose as the secretion from the Meibomian glands.

The *puncta lachrymalia*, (one of ~~these~~ being found in each lid) are the commencements of the lachrymal ducts which pass inward toward the nose and unite in the lachrymal sac which again is itself the superior expansion of the ductus ad nasum.

The bony canal ~~is~~ formed by the os
unguis and the superior maxillary
bone and opens into the inferior meatus
of the nose. Through these excretory
ducts all of which are lined by mu-
cous membrane the tears pass after
having fulfilled their office of lu-
bricating the Conjunctives.

The eyebrows and eyelashes, the
position and functions of which are
so familiar as to preclude the need-
sity of a description, complete the
appendages of the eye and close our
remarks upon this subject.

One thousand eight hundred and fifty-three
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